

REMARKS

Claims 1, 2, 9, 10, 13, 14, 17, and 18 were rejected under 35 U.S.C. §103(a) as being unpatentable over Kawahara et al., U.S. Patent No. 4,696,021, in view of Applicant's Admitted Prior Art (AAPA). Claims 5, 6, 15, and 16 were rejected under 35 U.S.C. §103(a) as being unpatentable over Kawahara et al. in view of Applicant's Admitted Prior Art (AAPA), and Lee et al., U.S. Patent No. 5,903,021.

As indicated in the amendment filed herein on May 24, 2004, Figs. 4D and 4E ($t_5 < t < t_6$) in Kawahara et al. shows operations of a CCD in an exposure time ($t_3 < t < t_6$) of Fig. 3 and that signal charges produced at photodiode 1 transfer to the vertical transfer CCD 3 in $t_5 < t < t_6$ (see column 5, line 67, to column 6, line 6). In other words, in Kawahara et al., an exposure operation and an operation of reading out from photodiodes 1 to the vertical transfer CCD 3 are carried out at the same time. In the exposure operation and operation of reading out, (see Figs. 4D and 4E), the potential barrier under clear gate 8 is decreased and fixed.

On the other hand, in the present invention and the prior art discussed in the present application, an exposure operation and an operation of reading out from the photo-electric conversion unit are carried out separately, as claimed in amended independent claim 1, and as supported in the specification on page 2, line 26, to page 3, line 23, and on page 8, line 5, to page 9, line 23. The electric potential barrier is raised up for the operation of reading out more than for the exposure operation, as claimed in amended independent claim 1, and as supported in the specification on page 8, lines 21-25.

In addition, a potential barrier under transfer gate 5 in Kawahara et al. is maintained between photodiode 1 and vertical transfer CCD 3 which is next to the photodiode 1 as shown in Figs. 4A to 4G and is not maintained between a photo-electric conversion unit and an OFD

structure which is next to the photo-electric conversion unit. A potential barrier under clear gate 8 in Kawahara et al. is maintained between the vertical transfer CCD 3 and overflow drain (OFD) 2' which is next to the vertical transfer CCD 3 as shown in Figs. 4A to 4G and is not maintained between a photo-electric conversion unit and an OFD structure which is next to the photo-electric conversion unit.

Further, in the present invention, the electric potential barrier is maintained between a photo-electric conversion unit and the OFD structure which is next to the photo-electric conversion unit, and the electric potential barrier is set to be higher in a read-out period than in a storing period of signal charges. Therefore, the leakage of signal charges due to self-induced drift or thermal diffusion is suppressed, (page 8, lines 21 to 25 in the present application).

On the other hand, Kawahara does not disclose that the electric potential barrier under overflow control gate 4 is set to be higher in a read-out period than in a storing period of signal charges. In other words, the electric potential barrier under overflow control gate 4 in Kawahara et al. is not raised up in Figs. 4A to 4G. Therefore, the leakage of signal charges is not suppressed.

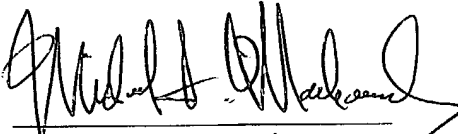
CLOSING

An earnest effort has been made to be fully responsive to the Examiner's objections. In view of the above amendments and remarks, it is believed that independent claim 1 is in condition for allowance, as well as those claims dependent therefrom. Passage of this case to allowance is earnestly solicited.

However, if for any reason the Examiner should consider this application not to be in condition for allowance, he is respectfully requested to telephone the undersigned attorney at the number listed below prior to issuing a further Action.

Any fee due with this paper, not fully covered by an enclosed check, may be charged on Deposit Account 50-1290.

Respectfully submitted,



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